CLAIMS

What is claimed is:

1. A sensing fibre for use in a distributed temperature sensing system, comprising:

an optical fibre for spatially extended deployment within a measurement region, the optical fibre incorporating:

a reflective element; and

a coiled fibre portion associated with the reflective element and positioned adjacent a distal side of the reflective element, the coiled fibre portion contributing substantially nothing to the spatial extent of the optical fibre when deployed.

2. A sensing fibre according to claim 1, in which the optical fibre is provided with a connector at its proximal end for connecting the optical fibre to a distributed temperature sensing system unit.

3. A sensing fibre according to claim 1 or claim 2, in which the optical fibre further incorporates one or more further reflective elements, and a coiled fibre portion associated with each of the one or more further reflective elements and positioned adjacent a distal side of its associated further reflective element.

4. A sensing fibre according to any preceding claim, in which the optical fibre further incorporates a further coiled fibre portion associated with the or each reflective element and positioned adjacent a proximal side of its associated reflective element, the further coiled fibre portion contributing substantially nothing to the spatial extent of the optical fibre when deployed.

5. A sensing fibre according to any preceding claim, in which the optical fibre is further provided with a connector at its distal end for connecting the optical fibre to a distributed temperature sensing system unit.

6. A sensing fibre according to any one of claims 1 to 5, in which the or each coiled fibre portion has a length in the range 1 m to 500 m.

7. A sensing fibre according to any one of claims 1 to 5, in which the or each coiled fibre portion has a length in the range 1 m to 100 m.

8. A sensing fibre according to any one of claims 1 to 5, in which the or each coiled fibre portion has a length in the range 1m to 50 m.

9. A sensing fibre according to any preceding claim, in which one or more of the or each reflective element comprises a join between two portions of optical fibre.

10. A sensing fibre according to claim 9, in which the join comprises abutted end facets of the two portions of optical fibre, each facet arranged at an acute angle to a longitudinal axis of the optical fibre to reduce back-reflection of incident light.

11. A sensing fibre according to claim 9 or claim 10, in which the join is implemented via an optical fibre connector.

12. A distributed temperature sensing system comprising:

a sensing fibre according to any one of claims 1 to 11;

an optical source operable to launch pulses of probe light into the proximal end of the sensing fibre; and

a detector operable to detect light emitted from the proximal end of the sensing fibre arising from Raman scattering of the probe light within the sensing fibre, the detected light indicative of temperature along the spatial extent of the sensing fibre, and to generate an output signal representative of the detected light.

13. A distributed temperature sensing system according to claim 12, in which, in use, the detector becomes saturated by Raman scattered light reflected from the or each reflective element and has a recovery time after saturation, and the or each coiled fibre portion has a length not less than a distance the Raman scattered light can propagate in the sensing fibre during the recovery time.

14. A distributed temperature sensing system according to claim 12 or claim 13, and further comprising a processor operable to receive the output signal from the detector and to determine a profile of temperature along the spatial extent of the fibre from the output signal.

15. A distributed temperature sensing system according to claim 12 or claim 13, and further comprising a processor operable to receive the output signal from the detector and to remove from the output signal a part or parts corresponding to detected light received from the or each coiled fibre portion.

16. A distributed temperature sensing system according to claim 15, in which the processor is further operable to determine a profile of temperature along the spatial extent of the fibre from the output signal.

17. A method of distributed temperature sensing comprising:

deploying an optical fibre in a measurement region in a spatially extended deployment, the optical fibre incorporating a reflective element and a coiled fibre

portion associated with the reflective element and positioned adjacent a distal side of the reflective element, the coiled fibre portion contributing substantially nothing to the spatial extent of the deployed optical fibre;

launching a pulse of probe light into a proximal end of the optical fibre;

detecting light emitted from the proximal end of the optical fibre arising from Raman scattering of the probe light within the optical fibre, the detected light indicative of temperature along the spatial extent of the optical fibre;

generating an output signal representative of the detected light;

removing from the output signal a part corresponding to detected light received from the coiled fibre portion; and

determining a profile of temperature along the spatial extent of the fibre from the output signal.

18. A method of distributed temperature sensing according to claim 17, in which the detecting is performed using a detector that becomes saturated by Raman scattered light reflected from the reflective element and has a recovery time after saturation, and the coiled fibre portion has a length not less than a distance the Raman scattered light can propagate in the optical fibre during the recovery time.

19. A method according to claim 17 or claim 18, in which the optical fibre further incorporates one or more further reflective elements and a coiled portion associated with each of the one or more further reflective elements and positioned adjacent a distal side of its associated further reflective element.

20. A method according to any one of claims 17, 18, or 19, in which the optical fibre further incorporates a further coiled fibre portion associated with the or each reflective element and positioned adjacent a proximal side of its associated reflective element, the further coiled fibre portion contributing substantially nothing to the spatial extent of the deployed optical fibre, the method further comprising:

launching a pulse of probe light into a distal end of the optical fibre;

detecting light emitted from the distal end of the optical fibre arising from Raman scattering of the probe light within the optical fibre, the detected light indicative of temperature along the spatial extent of the optical fibre;

generating a second output signal representative of the detected light from the distal end of the fibre;

removing from the second output signal parts corresponding to detected light received from the coiled fibre portion and the further coiled portion;

removing from the said output signal a part corresponding to detected light received from the further coiled portion; and

determining a profile of temperature along the spatial extent of the fibre from the output signal and the second output signal.

21. A method according to any one of claims 17 to 20, in which the or each coiled fibre portion has a length in the range 1 m to 500 m.

22. A method according to any one of claims 17 to 20, in which the or each coiled fibre portion has a length in the range 1 m to 100 m.

23. A method according to any one of claims 17 to 20, in which the or each coiled fibre portion has a length in the range 1 m to 50 m.

24. A method according to any one of claims 17 to 23, in which one or more of the or each reflective elements comprises a join between two portions of optical fibre.

25. A method according to claim 24, in which the join comprises abutted end facets of the two portions of optical fibre, each facet arranged at an acute angle to a longitudinal axis of the optical fibre to reduce back-reflection of incident light.

26. A method according to claim 24 or claim 25, in which the join is implemented via an optical fibre connector.

5